Fully Interoperable First Responder Alerting System Based on ReFLEX Two-Way Messaging Technology

by
Barrett M. Kanne
Founder and President
TGA Technologies, Inc.
Norcross, GA

BACKGROUND

In the aftermath of any major public safety event, either natural or man-made, there are renewed calls for "interoperable communications." This requirement dictates that a variety of responding agencies can coordinate their communication activities at the scene—where it matters most. Attempts to resolve this interoperability[1] issue have ranged from audio patching systems to the provision of new digital radios quickly brought to the same group of channels. These solutions, however, ***do not*** address the initial alert of the responders and the subsequent on-scene warnings once they arrive.

TGA Technologies, Inc., a 15-year-old company with a rich history in the radio paging industry, has developed what it believes is the answer to alerting responders, and subsequently warning them at the scene to evacuate or take other protective measures. The TGA Sparkgap Responder Network utilizes a Motorola, Inc. developed protocol for two-way paging and Narrowband PCS (NPCS) called ReFLEX™.

This system uses two nationwide 900 MHz channel pairs operating in a 12.5KHz mode. For purposes of this discussion, we will refer to these as national response channels. Public NPCS networks have traditionally been deployed using this technology and infrastructure. These

[1] What is interoperability? – It is the ability of public safety personnel in different agencies or jurisdictions to communicate with each other by radio on demand, in real time. It is necessary for a wide range of operations:
- Mutual-aid responses to catastrophic accidents or disasters by many public safety agencies,
- Routine day-to-day coordination to handle events like fires or vehicle chases, and
- Extended task force operations involving local, state, and federal agencies to address a public safety challenge (e.g., long-term disaster recovery, security for major events, or drug trafficking). http://www.safecomprogram.gov/policy_issues.cfm

networks provide two-way wireless messaging that is more reliable and effective than the current voice networks used by emergency workers and public employees who respond to critical situations.[2] By using multiple overlapping transmission sites, ReFLEX signals do not rely on a single cell site for communication. The multi-site configuration tends to boost signal reliability, especially in urban areas.

THE ELEMENTS

Virtually all first responders, be they police, fire, EMS, or others, generally carry a paging device. This is especially true in the case of volunteer fire fighters and EMS personnel serving much of our country. Of the fire departments registered with the National Fire Department Census, 87 percent are volunteer or mostly volunteer.[3] For them, pagers provide a dependable method for alerting groups of personnel to an incident requiring a response. Traditionally, however, these have been one-way pagers or beepers sounding the alert along with some text or voice information. That's the good news, but what about the bad?

In most cases, the incident commander has no idea who is responding to support the event—until the responders arrive. The fact that the turn out rate is high, especially in rural communities is comforting, but the question always lingers as to the number of personnel actually responding, and more importantly will there be a need for mutual aid? The TGA Sparkgap Responder Network, uses paging devices that can actually ***respond.*** That is, they can send back a reply from a list of possible answers applicable to the incoming alert message. Notifying dispatchers of responding personnel can save valuable time if the event requires mutual aid.

---

[2] *Wireless Messaging for Homeland Security: Using Narrowband PCS for Improved Communication During Emergencies*, Peter Kapsales, March 2004. http://www.homelandsecurity.org/journal/Articles/Kapsales.html

[3] As of April 1, 2004, there were 22,250 fire departments registered with the National Fire Department Census. This is about 75% of the departments estimated to be in the United States . . . The fire departments registered with the census are staffed by approximately 40,800 fire stations across the country. The fire departments registered with the census are staffed by approximately 1, 036,000 personnel. This figure includes career, volunteer, and paid per call firefighters, civilian staff, and non firefighting personnel. Department of Homeland Security, Federal Emergency Management Agency (FEMA). http://www.usfa.fema.gov/applications/fdonline/summary.cfm

Once on the scene, communicating an impending danger falls back to the use of individual organization's radio systems. Not all personnel will have the ability to switch their radio to a common "fire ground" channel. That is where the new TGA Sparkgap Responder Network comes in to support those in command.

It is for this reason that the TGA Sparkgap Responder Network was developed. It is ***not*** intended to take the place of voice radios used to relay details of activities at the event to the command post. Rather, it is designed to do what pagers do best—quickly and reliably alert large numbers of users (simultaneously) and respectively report receipt of the message to the command post in a fully automated way and at relatively low-cost.

THE TGA RESPONDER PAGER

The evolution of two-way paging technology led to the ability for pagers to no longer be "locked" on a single channel for service, but rather to scan in the background for a better, stronger signal to serve them. It is this background scanning that is the heart of the TGA Sparkgap Responder Network. It is this ability that allows these devices to seek out the correct channel for temporary use at the scene of an event.

TGA has developed a pager called the TGA Responder 1501 to be used by responding personnel, not only at the time of an incident, but on a day-to-day basis. These pagers operate on any programmed ReFLEX 2.7.x network. On a daily basis, the Responder 1501 pager can be part of a private or public paging network. When the person using this device arrives at the site of an event with an established on-scene network (TGA Sparkgap RD-1000), the pager will automatically:

- Find this temporary system,
- Switch to the proper channel, and
- Check in.

As long as that pager is in the coverage area of the TGA Sparkgap RD-1000, it will be a part of the community of pagers receiving messages from the command post for that particular occurrence. Once the on-scene network is shutdown, or the responder leaves the coverage

area, the pager will revert to its normal use and channel. Any messages sent via its normal network will be delivered when the pager routinely re-registers with that network.

In addition to the ability to automatically find the channel being used at the scene of a major event, the TGA Responder 1501 is also equipped with louder than normal (>85 dB at 30 cm) alerting tone and strong vibrator to ensure the user is aware of an incoming message. Messages may be either sent to an individual pager, a group of pagers, or the entire community of pagers at the event to get the alert out in the most efficient time. Plus, optional AES encryption is available to prevent inappropriate interception of official message traffic.

THE FREQUENCIES

Modern wide-area paging networks utilize the 900 MHz band of radio spectrum. Some of these channels are dedicated to the NPCS Radio Service (FCC Part 24) and others are found in Business and Industrial Radio Service (FCC Part 90) making them available to a wide range of system operators.

The TGA Responder 1501 paging device is designed to use frequencies in either or both of these channel segments based on programming within the paging device itself. For example, a public safety organization could either:

- Contract for the paging services of a local or national public carrier using the NPCS channels. This would provide day-to-day operation for dispatch of emergency alerts for that locality. At the same time, these pagers could be preprogrammed with the national response channels incorporated in all paging devices meeting the ReFLEX 2.7.x specification used by members of the first responder community.

- Establish a private ReFLEX paging network to serve official personnel. Such a system would handle the normal traffic of their agency, but the devices could still be programmed to revert to one of the national response channels as needed.

Because of the relatively short range of the RD-1000 systems, it would be possible to have several events occurring in a regional area, utilizing the same channel, without any harmful interference. If the sites were too closely spaced, it would be appropriate to use the other of the two national response channel pairs to provide frequency diversity and eliminate co-channel interference.

AT THE SCENE

When a major public safety event occurs, it is normal for the involved agencies to establish a command post at or near the scene of the event. Many times this is a motor home style vehicle equipped to resemble a control room with banks of computers, radios and a meeting area used for staff briefings.

As a critical part of this command post, the jurisdiction would install a TGA Sparkgap RD-1000 portable messaging network to take control of the ReFLEX 2.7.x paging devices carried to the scene by various responders. Once this system is activated, pagers that are preprogrammed with the national response channels would lock on to the network at the scene and "check in." A display of all registered paging devices could be used to monitor the presence of personnel as they arrive.

If it was necessary to call a general evacuation of the scene, this message would be sent via the RD-1000 and each device would acknowledge receipt and reading of the message. The beauty of paging is it allows a message to be sent to multiple users at the same time. The site

command personnel would have an instant view of those who did not respond to the alert and could take immediate alternative action to get the message to them.

Paging can be the electronic equivalent of a lifeline attached to each person at the scene. Notifying them to evacuate by sending an alert message would be like pulling on that line and getting a tug as a response. The structure of a paging network provides the highest efficiency when it comes to alerting multiple users to an important message. And more importantly, the TGA Sparkgap Responder Network gives the scene commander a confirmed indication that the message was received and read by the personnel to whom it was sent.

SUMMARY

As an example of challenging communication related issues, one only has to look to the Arlington County [VA] *After Action Report on the Response to the September 11 Terrorist Attack on the Pentagon*:

> "Almost all aspects of communications continue to be problematic, from initial notification to tactical operations . . . Radio channels were initially oversaturated and interoperability problems among jurisdictions and agencies persist. Even portable radios that are otherwise compatible were sometimes preprogrammed in a fashion that precluded interoperability. Pagers seemed to be the most reliable means of notification when available and used, but most firefighters are not issued pagers."[4]

When carried by all first responders of various jurisdictions, the TGA Responder 1501 pager would not only offer the ability to get an alert, but would signal as each responder received and read their message. The pagers would be used in the performance of the first responder's everyday duties, but once on the scene of an incident, the pagers could be preprogrammed to

[4] *Arlington County After Action Report on the Response to The September 11 Terrorist Attack on the Pentagon,* page 61. http://www.arlingtonva.us/departments/Fire/edu/about/docs/after_report.pdf

lock onto a system setup at the scene and become (while they are on-scene) a member of the event's communications network. All of this can take place without any intervention on the part of the responder.

At the disaster scene, the fully portable RD-1000 system does not rely on any land-based infrastructure for its operation. Thus, in times when commercial power is not available, the system can be used, as all elements can be supported by batteries or other portable power devices. Alerting is the start of any emergency service response and the TGA Sparkgap Responder Network performs that task effectively and economically.

The ability to ***know*** the messages have been received and read by the targeted recipient closes the loop for commanders trying to cope with large incident scenes or dispatchers determining the need for mutual aid response. The fact that the equipment is used in normal everyday activities means no special training or devices are needed when disaster strikes. The responder is already equipped and trained.

Author contact:
Barrett M. Kanne, President
TGA Technologies, Inc.
100 Pinnacle Way, Suite 140
Norcross, GA 30071-3633
barry@tga.com